

Claims

- [c1] CLAIM 1. A method for plaque characterization, the method comprising:
obtaining a first set of image data created in response to a first x-ray energy level and including a plurality of first pixel elements, wherein each said first pixel element corresponds to a unique location in an object being scanned;
obtaining a second set of image data created in response to a second x-ray energy level and including a plurality of second pixel elements, wherein each said second pixel element corresponds to one said first pixel element and wherein said second x-ray energy level is higher than said first x-ray energy level; and
calculating a third set of image data in response to said first set of image data and said second set of image data, wherein said calculating includes subtracting each said second pixel element from said corresponding first pixel element.
- [c2] CLAIM 2. The method of claim 1 wherein each said second pixel element is created in close time proximity to each said corresponding first pixel element.
- [c3] CLAIM 3. The method of claim 2 wherein said close time proximity is one millisecond or less.
- [c4] CLAIM 4. The method of claim 1 wherein each said second pixel element and each said corresponding first pixel element are created within the same scan in an interleaving pattern.
- [c5] CLAIM 5. The method of claim 1 wherein said object is a patient.
- [c6] CLAIM 6. The method of claim 1 wherein said first x-ray energy level is 80 kilovolts.
- [c7] CLAIM 7. The method of claim 1 wherein said second x-ray energy level is 140 kilovolts.
- [c8] CLAIM 8. The method of claim 1 wherein said object being scanned was injected with a contrast agent.
- [c9] CLAIM 9. The method of claim 1 further comprising displaying said first set of

image data, said second set of image data and said third set of image data.

[c10] CLAIM 10. The method of claim 1 wherein said first set of image data, said second set of image data and said third set of image data were created as non-contrast images, and wherein claim 1 further comprises:

obtaining a fourth set of image data created in response to said first x-ray energy level and including a plurality of fourth pixel elements, wherein each said fourth pixel element corresponds to a said first pixel element and wherein said fourth set of image data was created as a contrast image;

obtaining a fifth set of image data created in response to said second x-ray energy level and including a plurality of fifth pixel elements, wherein each said fifth pixel element corresponds to a said fourth pixel element and wherein said fifth set of image data was created as a contrast image; and

calculating a sixth set of image data in response to said fourth set of image data and said fifth set of image data, wherein said calculating a sixth set of image data includes subtracting each said fifth pixel element from said corresponding fourth pixel element.

[c11] CLAIM 11. The method of claim 10 further comprising displaying said fourth set of image data, said fifth set of image data and said sixth set of image data.

[c12] CLAIM 12. The method of claim 10 further comprising:
calculating a seventh set of image data in response to said first set of image data and said fourth set of image data, wherein said calculating a seventh set of image data includes subtracting each said first pixel element from said corresponding fourth pixel element;

calculating an eighth set of image data in response to said second set of image data and said fifth set of image data, wherein said calculating a seventh set of image data includes subtracting each said second pixel element from a corresponding fifth pixel element; and

calculating a ninth set of image data in response to said third set of image data and said sixth set of image data, wherein said calculating a ninth set of image data includes subtracting each said third pixel element from a corresponding sixth pixel element.

- [c13] CLAIM 13. The method of claim 12 further comprising displaying said seventh set of image data, said eighth set of image data and said ninth set of image data.
- [c14] CLAIM 14. The method of claim 10 further comprising:
calculating a composite set of image data in response to at least one of said first set of image data, said second set of image data, said third set of image data, said fourth set of image data, said fifth set of image data and said sixth set of image data.
- [c15] CLAIM 15. The method of claim 14 further comprising displaying said composite set of image data.
- [c16] CLAIM 16. The method of claim 1 further comprising:
locating a vessel of interest in said object, wherein said object was injected with a contrast agent;
tracking a flow of said contrast agent through said vessel; and
quantifying plaque in said vessel in response to said third set of image data and to said flow.
- [c17] CLAIM 17. The method of claim 16 wherein said tracking is performed in response to said second set of image data.
- [c18] CLAIM 18. The method of claim 16 further comprising determining the characteristics of said plaque in response to said third set of image data.
- [c19] CLAIM 19. A method for plaque characterization, the method comprising:
obtaining image data created in response to an x-ray energy level and an object injected with a contrast agent;
locating a vessel of interest in said object;
tracking a flow of said contrast agent through said vessel;
identifying soft plaque in said vessel in response to said image data and to said flow;
plotting the distribution of said soft plaque; and
determining the vulnerability of said soft plaque in response to said distribution.

- [c20] CLAIM 20. A system for plaque characterization, the system comprising:
an imaging system;
an object disposed so as to be communicated with said imaging system,
wherein:
said imaging system generates a first set of image data and a second set of
image data responsive to said object;
said first of set of image data is created in response to a first x-ray energy level
and includes a plurality of first pixel elements;
each said first pixel element corresponds to a unique location in said object;
said second set of image data is created in response to a second x-ray energy
level and includes a plurality of second pixel elements;
each said second pixel element corresponds to one said first pixel element; and
said second x-ray energy level is higher than said first x-ray energy level; and
a processing device in communication with said imaging system including
software to implement the method comprising:
obtaining said first set of image data;
obtaining said second set of image data; and
calculating a third set of image data in response to said first set of image data
and said second set of image data, wherein said calculating includes subtracting
each said second pixel element from said corresponding first pixel element.
- [c21] CLAIM 21. The system of claim 20 wherein said object is a patient.
- [c22] CLAIM 22. The system of claim 20 wherein said imaging system is a computed
tomography imaging system.
- [c23] CLAIM 23. The system of claim 20 wherein said imaging system and said
processing device are physically located in the same geographic location.
- [c24] CLAIM 24. The system of claim 20 wherein said imaging system and said
processing device are physically located in different geographic locations.
- [c25] CLAIM 25. The system of claim 20 wherein said processing device is in
communication with said imaging system over a network.
- [c26] CLAIM 26. The system of claim 25 wherein said network is the Internet.

- [c27] CLAIM 27. A computer program product for plaque characterization in cardiac applications, the product comprising:
a storage medium readable by a processing circuit and storing instructions for execution by the processing circuit for:
obtaining a first set of image data created in response to a first x-ray energy level and including a plurality of first pixel elements, wherein each said first pixel element corresponds to a unique location in an object being scanned;
obtaining a second set of image data created in response to a second x-ray energy level and including a plurality of second pixel elements, wherein each said second pixel element corresponds to one said first pixel element and wherein said second x-ray energy level is higher than said first x-ray energy level; and
calculating a third set of image data in response to said first set of image data and said second set of image data, wherein said calculating includes subtracting each said second pixel element from said corresponding first pixel element.
- [c28] CLAIM 28. The computer program product of claim 27 wherein each said second pixel element and said corresponding first pixel element are created with the same scan in an interleaving pattern.
- [c29] CLAIM 29. A computer program product for plaque characterization in cardiac applications, the product comprising:
a storage medium readable by a processing circuit and storing instructions for execution by the processing circuit for:
obtaining image data created in response to an x-ray energy level and an object injected with a contrast agent;
locating a vessel of interest in said object;
tracking a flow of said contrast agent through said vessel;
identifying soft plaque in said vessel in response to said image data and to said flow;
plotting the distribution of said soft plaque; and
determining the vulnerability of said soft plaque in response to said distribution.